IN THE U.S. PATENT AND TRADEMARK OFFICE

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For : ADHESIVE SHEET CAPABLE OF REPEATED ADHESION AND RELEASE
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DECLARATION UNDER 37 CFR 1.132

We, the undersigned, hereby declare as follows:

We are the inventors of the invention described and claimed in United States patent application Serial No. 10/009 204, filed December 4, 2001.

We hereby incorporate by reference herein the contents of all examples contained in the specification of the above-mentioned application.

We have performed the following additional tests in order to demonstrate the unobviousness effects of the adhesive sheet claimed in this application.

ADDITIONAL TESTS

Preparation of Test Pieces

A PET (polyethylene terephthalate) film 12 μm thick was laminated with a CPP (cast polypropylene) film 60 μm thick to

provide a composite film with a PET//CPP structure, as shown in FIG. A, as a substrate film 1. The total thickness of the substrate film including an adhesive thickness between the PET film and the CPP film was 80 μm. The surface of the substrate film 1 was coated with an acrylate-type adhesive agent (TS-1931 made by Nippon Carbide Ind. Co., Inc.) using an applicator to form an adhesive agent layer 2, onto which two strips of OPP (biaxially oriented polypropylene) film were adhered as a non-adhesive protective material layer 3. The non-adhesive protective material layer having a thickness of 50 μm, 100 μm or 150 μm shown in the following tables was formed by laminating the necessary number of 25 μm thick OPP films. Thus, a partially covered adhesive sheet shown in FIG. A was prepared. The coating amount of the adhesive agent was 45g/m and the thickness T and the width W1 between the two strips of the protective material layer were varied as shown in the following tables.

As an object 4 to be adhered to the above adhesive sheet, a composite film with a PET//CPP structure was prepared similarly to the above-mentioned substrate film 1.

Test Procedures

Using the above test pieces, the relationship between the size of the space on the exposed portion of the adhesive agent layer 2 and the adhesive strength (Test 1) and the relationship between the thickness of the non-adhesive protective material layer 3 and the static friction of the adhesive sheet (Test 2) were examined.

Test 1:

The exposed portion of the adhesive agent layer 2 was pressed against the CPP film side of the object 4 under a pressure of 0.02 MPa/cm^2, 0.1 MPa/cm^2 or 0.2 MPa/cm^2 applied for 5 seconds from the back of the adhesive sheet and the adhesive sheet and the object were stuck together as shown in FIG. B. This adhesion

test was conducted for two cases.

In one case, the adhesive sheet and the object to be stuck together were sandwiched between two silicone rubber plates having a thickness of 2 mm and a hardness of 50° and were stuck together under the above pressure.

In another case, the above pressure was applied from the back of the adhesive sheet without using the silicone rubber plates.

FIG. B shows the adhesive sheet and the object after they were stuck together in which the exposed portion of the adhesive agent layer 2 stuck to the facing face of the object 4. In FIG. B, W2 is the adhesion width between the adhesive agent layer and the facing face of the object 4 and the adhesive sheet has a wavy form.

The adhesive strength of the adhesive sheet to the object 4 was measured for each test piece having a length of 20 mm by pulling the test piece upward at a rate of 300 mm/min using a tensile tester, as shown in FIG. C. The test results are shown in Tables A-1, A-2, A-3, B-1, B-2 and B-3. Tables A-1, A-2, A-3 show the relationship between the adhesion width W2 and the width W1 between strips of the non-adhesive protective material layer 3 shown in FIG. B. Tables B-1, B-2 and B-3 show the relationship between the adhesive strength (N) and the width W1 and thickness T of the non-adhesive protective material layer 3. In the tables, the test results in column "A" are those of the case where adhesion of the adhesive sheet to the object was performed using the silicone rubber plates and the test results in column "B" are of the case where the adhesion was performed without using the silicone rubber plates. In the above tests, variation of the surface area of the exposed portion of the adhesive agent layer was represented by varying W1.

Table A-1 (W1 = 2 mm)

T(μm)	W2(mm) (0.02 MPa/cm²)		W2(mm) (0.1 MPa/cm²)		W2(mm) (0.2 MPa/cm²)	
	A	B	A	B	A	B
20	0.7	–	1.2	0.7	1.4	0.8
50	–	–	–	–	0.8	–
100	–	–	–	–	–	–
150	–	–	–	–		–

Table A-2 (W1 = 3 mm)

T(μm)	W2(mm) (0.02 MPa/cm²)		W2(mm) (0.1 MPa/cm²)		W2(mm) (0.2 MPa/cm²)	
	A	B	A	B	A	B
20	1.9	0.7	2.2	1.3	2.4	2.0
50	1.6	–	2.0	0.7	2.1	0.8
100	1.3	–	1.4	–	1.4	–
150	0.8	–	1.2	–	0.7	–

Table A-3 (W1 = 4 mm)

T(μm)	W2(mm) (0.02 MPa/cm²)		W2(mm) (0.1 MPa/cm²)		W2(mm) (0.2 MPa/cm²)	
	A	B	A	B	A	B
20	3.0	2.9	3.3	3.0	3.4	3.4
50	2.4	1.2	2.9	1.4	3.0	1.6
100	2.1	0.7	2.5	1.4	2.6	1.4
150	1.0	0.7	1.4	1.0	1.7	1.2

Table B-1 (W1 = 2 mm)

T(μm)	Adhesive strength (N) (0.02 MPa/cm²)		Adhesive strength (N) (0.1 MPa/cm²)		Adhesive strength (N) (0.2 MPa/cm²)	
	A	B	A	B	A	B
20	2.8	–	4.1	–	4.5	0.8
50	–	–	–	–	*	–
100	–	–	–	–	–	–
150	–	–	–	–	–	–

Table B-2 (W1 = 3 mm)

T(μm)	Adhesive strength (N) (0.02 MPa/cm²)		Adhesive strength (N) (0.1 MPa/cm²)		Adhesive strength (N) (0.2 MPa/cm²)	
	A	B	A	B	A	B
20	9.6	*	13.0	4.4	14.1	6.0
50	9.4	-	12.1	*	13.8	2.7
100	7.2	-	10.3	-	11.3	-
150	5.7	-	10.0	-	10.8	-

Table B-3 (W1 = 4 mm)

T(μm)	Adhesive strength (N) (0.02 MPa/cm²)		Adhesive strength (N) (0.1 MPa/cm²)		Adhesive strength (N) (0.2 MPa/cm²)	
	A	B	A	B	A	B
20	9.7	8.1	24.8	12.2	15.3	12.8
50	9.4	7.8	13.0	9.9	14.1	10.3
100	7.2	2.9	10.3	5.6	11.3	5.5
150	5.7	*	10.0	3.1	10.8	3.8

Note:

In the table, "-" represents that no adhesion occurred, and "*" represents that the adhesion strength was too poor and could not be measured.

It is clear from the test results shown in Table A-1 to A-3 that the width W2 of the adhesive agent layer adhered to the object is increased by increasing the width W1 between the strips of the protective material layer 3 or decreasing the thickness T of the protective material layer 3. The test results in Tables B-1 to B-3 indicate that increase in W1 and decrease in T enhance the adhesive strength of the adhesive sheet to the object 4. These results demonstrate that the size (i.e., the volume) of the space on the exposed portion of the adhesive agent layer correlates closely to the adhesive strength of the adhesive. Especially, when the area of the exposed portion of the adhesive agent layer is increase, as referred to in the case of W1 being 4 mm, the thickness T of the non-adhesive protective material layer makes a great contribution to the control of the adhesive strength.

It is clear from the above results that it is possible to obtain an adhesive sheet exhibiting a desired adhesive strength to an object by controlling the total volume of spaces on the exposed portions of the adhesive agent layer.

Test 2:

The relationship between the thickness T of the non-adhesive protective material layer and the static friction was examined.

The adhesive sheet prepared as described above was set as a test piece, as shown in FIG. D in which the non-adhesive protective material layer faced a sheet of Teflon (trade name). The Teflon sheet is actually stuck onto a bag making machine to smoothly forward the adhesive sheet on the machine. This test was also conducted without using the Teflon sheet in which the non-adhesive protective material layer faced a glass plate. The force of the static friction was measured by horizontally sliding the adhesive sheet with a spring balance, as shown in FIG. E. The test results are shown in Table C.

Table C (W1 = 3 mm)

T(μm)	Force of static friction (g)	
	With Teflon sheet	Without Teflon sheet
20	50	150
50	20	not more than 10
100	20	not more than 10

When the thickness T of the non-adhesive protective material layer was 20μm, the force of static friction in the horizontal direction was 50 g or 150 g and sticking of the adhesive sheet to the Teflon sheet or the glass plate was observed. However, when the thickness T was 50μm or greater, the static friction was small and the adhesive sheet could smoothly slide on the Teflon sheet or the glass plate without sticking. Accordingly, an adhesive sheet having a properly

adjusted thickness T, which is one of the factors for calculating the total volume of spaces on the exposed portions of the adhesive agent layer, can be used for making bags and putting food, etc., into the bags on a bag making and filling machine without any mechanical trouble or difficulties.

When the surface level of the exposed portions of the adhesive agent layer is the same level as the surface of the non-adhesive protective material layer, the adhesive sheet cannot be used on the above machine because of sticking to the machines or operator's fingers.

DISCUSSION OF RESULTS

As seen from the above, the adhesive sheet having a structure as set forth in claims of this application can exhibit a desired adhesive strength when it is adhered to an object and can be handled without sticking to undesired areas or parts or used on machines without any mechanical trouble or difficulties, such as sticking to them, because it is provided with spaces having a total volume based on the adhesive strength to the object on the exposed portions of the adhesive agent layer.

We hereby declare that all statements made herein of our own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: April 14, 2004

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Encl: FIGs. A-E